

Yet another crystal set am broadcast band radio

ralph klimek 2001

Why do I or the world need yet another crystal-set design ?

This little project was motivated by me wanting to show the kids some cool technology. A radio that required no batteries or no source of external power, save that so generously provided by the advertisers of commercial AM broadcast stations. I revived for me rather nice memories of when I was very young trying to coax the last bit of performance from my earliest radios. It was allways a tradeoff between loudness and selectivity. In Melbourne Australia this really only meant being able to discriminate between the government stations at 620 and 770 khz which ran a 50KW transmitter and the more numerous commercial stations between 800 and 1600Khz any only running only 5KW. The meant in practice, being only able to resolve the big government radio and the commercials were reduced to a cacophony all trampling on each other. In those days nearly all the commercials carried horse racing or football on the weekends and this made for amusing listening. Often they would all call the same horse race and you could make out 5 stations at once blabbling out the same race call.

The classic crystal set design that is still taught to kids requires a coil of high inductance, chosen to resonate with what was the standard broadcast gang of 415pF max.

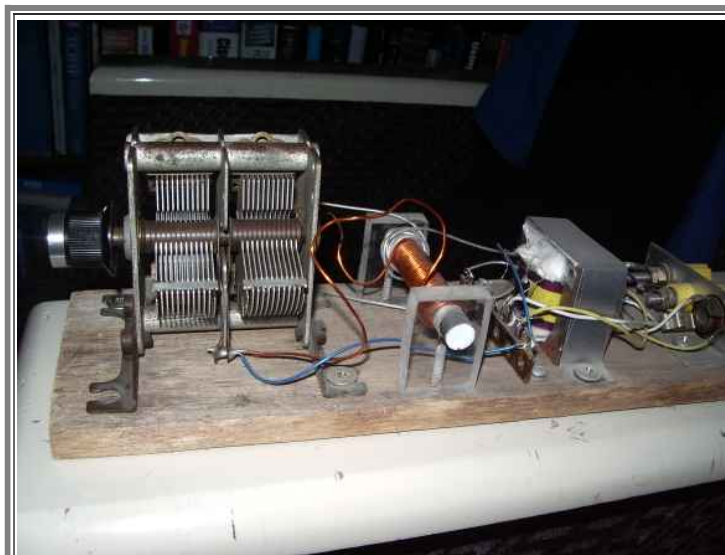
This is actually a rather poor choice. It means a poor Q at the low end and almost NO Q at the high end, which is why here in Melbourne the commercials could not be discriminated. That meant the "cool" stuff, the pop music and shock jocks could not be heard by me. So I acquired a taste for govenment news and solid classical music. I remember falling asleep while listening to the Week in Business or the haunting sounds of "In Choirs and Places" (radio 3AR) just before nightly close down with one of those horrible crystal earpieces (I called them "infecto-phones") making my ear very sore. But it was worth it because one of those shows in the sixties was the inspiring ABC Weekly Science Report which would lead me on to better things.

So this silly little project caused me to revisit the concept of Q and bandwidth and resonance. The classical crystal set performance was ruined by poor understanding of Q. The classical crystal set inductor has high inductance, presumably to resonate with a cheap low maximum value variable capacitor. High inductance is not a bad thing if that coil has low resistance, but at RF that is hard to do.

This radio's resonator has very small inductance and very high capacitance. Performance is not limited by the inductors resistance but only by the loading. The load is nothing more that the losses in the antenna and the rectifier. The diode is, of course, germanium. It feeds a step down transformer, not of audio design, but a mains frequency plug pack transformer which drives high impedance (600ohm) voice coil headphones. Any cheap ones will do. The coil should be wound with the heaviest gauge wire to hand, the ferrite core is optional, it serves merely to shorten the length of wire required and to make the coil size practical. Although not done here, the coil should be tapped half way to provide for 2 octaves of tuning. The large tuning capacitance effectively absorbs the capacitance of the antenna.

Now in practice, with an antenna that consists of nothing more than a 10 meter long heavy gauge wire running along the back fence, less than 3 meters above the ground and a good earth, this radio can resolve all of Melbourne's stations with minimal interference. The really suprising thing, it is possible to drive a large diameter loud speaker with this radio. I wouldnt call it loud, but rather, call it noticeable. At late night it could even be described as objectionable!

...and someone else is paying for the power!



old broadcast gang parrelled to give 900pF Max



Inductor has about 30 to 40 turns of 16 gauge wire

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